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A conceptual and analytical approach to comparative analysis of country case studies: HIV and TB control programmes and health systems integration

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Attempts to comparatively analyse large-scale communicable disease control programmes have, for the most part, neglected the wider health system contexts within which the programmes lie. In addition, many evaluations of the integration of vertical disease control programmes into health systems have focused on single case studies or on a limited number of cases, or, when large numbers of cases were drawn upon, have been presented as a compendium of monographs rather than a systematic cross-national comparison. One reason for this may be that appropriate theories and tools for comparative health systems analysis are rare and difficult to formulate. In this paper we propose a conceptual framework and an analytical methodology which might be used to comparatively analyse a series of case studies that explore health systems, communicable diseases programmes and concepts of integration in order to make systematic comparisons to offer novel insights, to test new theories and to offer new hypotheses. We illustrate through a preliminary analysis how this framework can be applied to compare the impact of health systems integration and HIV and TB programmes in four countries in South-East Asia that were the subject of cases studies.

Keywords Comparative analysis, framework, Global Fund, health systems, integration, methodology

Introduction

Attempts to comparatively analyse large-scale communicable disease control programmes have, for the most part, neglected the wider health system[1] contexts within which the programmes lie (Coker *et al*. 2008). Whilst research into health systems is an expanding field, a majority of analyses of health systems fail to adequately address and compare elements within the system, have encompassed limited numbers, or types, of cases and lack a robust conceptual framework and analytical methodology (Samb *et al*. 2009; de Savigny *et al*. 2009). Furthermore, most evaluations of the integration of vertical disease control programmes into health systems have focused on single case studies or on a limited number of cases, and when large numbers of cases were used, these studies were usually presented as a compendium of monographs rather than a systematic cross-national comparison (Samb *et al*. 2009). One reason for this, as suggested by the dearth of comparative

analytical frameworks and methodologies, may be that appropriate theories and tools are rare and difficult to formulate.

There is an urgent need, hence, to develop a framework for analysis that enables the systematic comparison of large amounts of data and information from multiple case studies in a robust, rigorous manner, in order to test new theories and to offer new hypotheses. Indeed, in the case of the Global Fund to Fight AIDS, Tuberculosis and Malaria (the Global Fund), the 5-year review of the impact of Global Fund investments was, despite being detailed and informative, limited analytically, in part because its underlying theoretical framework was undeveloped.

Here, we outline the development of a conceptual framework and an analytical methodology to comparatively analyse a series of country case studies commissioned by the Global Fund, in order to evaluate the impact of the organization's investment in the control of HIV and tuberculosis (TB) on the health system as a whole. The framework we propose describes how communicable disease control programmes and health systems, as well as the integration of the former into the latter, can be conceptualized in order to make systematic comparisons of several case studies, to test new theories and offer new hypotheses. To ensure coherence, the work draws upon four country case studies published in this supplement (Desai *et al*. 2010; Hanvoravongchai *et al*. 2010; Mounier-Jack *et al*. 2010; Rudge *et al*. 2010). The framework also illustrates how a large amount of data and information derived from multiple sources can be condensed, measured and compared for analytic purposes in a systematic manner. By systematic, we mean:

- An overall theory to govern analysis that provides testable and deducible propositions for comparative examinations;
- Rigorous comparisons made through the use of common categories, concepts or variables;
- The comparisons run throughout the body of work.

We present preliminary results based on examples from four countries in South-East Asia: Indonesia, Lao People's Democratic Republic (Lao PDR), Papua New Guinea (PNG) and Thailand.

Considerations in the development of the framework

The analytical framework outlined in this paper employs a mixed-methods approach, drawing upon both qualitative and quantitative data. We have previously noted that fundamental epistemological and ontological tensions can arise with research that draws upon multiple disciplines, a tension manifest in attempts to bridge fields that draw predominantly on either qualitative or quantitative data, and this may be part of the limitations of mixed-methods multidisciplinary research (Coker *et al*. 2004). However, if the purpose of research and analysis is to provide knowledge that can enhance the human condition, 'the perfect' should not be the enemy of 'the good'. Putnam's groundbreaking work, for example, on social capital through comparative analysis shows that it is possible to build robust theories and conduct analyses that meaningfully inform academic and policy debates (Putnam *et al*. 1995).

Insights gained from robust, systematic analyses are useful even if the conceptual frameworks and analytical methodologies have limitations. Any comparative analysis must acknowledge and attempt to address limitations that hinder the development of a thorough understanding. This response can include: (i) formulating a theory or building a conceptual and analytical framework that can generate explanations or plausible hypotheses to be examined; (ii) overcoming contextual variations that complicate meaningful comparisons; (iii) incorporating appropriate qualitative and quantitative data analytically; and (iv) collecting, processing and interpreting substantial amounts of data.

First, frameworks offer one way of looking at the world. In putting boundaries around constructs they are necessarily selective, magnifying the importance of some information whilst minimizing the importance of other information. As such, no framework offers perfect insight, and all frameworks will have relative merits and liabilities. The ultimate test of a framework is whether it describes and explains an issue or problem better or opens up new considerations compared with existing frameworks.

Secondly, a comparative analysis should offer insights that have meaning in a broad variety of contexts, that is, it must capture contextual meaning. The difficulty in defining a problem is necessarily subjective and any one definition may not describe all case studies within the analysis. For example, whilst multidrug-resistant tuberculosis (MDR-TB) may be iatrogenic in nature (though person to person spread is also a problem), erratic anti-TB drug administration may be framed in many ways: as an issue of patient autonomy, as a departure from accepted good professional clinical practice, as a logistical issue in the procurement and delivery of drugs, as a criminal justice problem, or as a financial system problem (Atun *et al*. 2005; Coker *et al*. 2008). Drug quality may also be an important element, with counterfeit drugs increasingly challenging public health control programmes. A comparative analysis must therefore be structured around a framework that addresses the same problem defined in the same way, whilst making allowances for variations in the problem in different contextual settings, thereby facilitating the ability to draw useful generalizations.

Thirdly, a framework and methodology for comparative analysis should employ concepts that are sensitive to both qualitative and quantitative differences in case studies and their component parts that might themselves be somewhat arbitrarily framed.

Lastly, comparative analysis of cases must be able to systematically collect and analyse a large mass of data. As the number of cases increases so too does the volume of evidence to be gathered through document analysis, routine data review and interviews. These data then need to be analysed and reduced to key themes or variables, compressed so they can be used and refined so they accurately reflect the variables to be measured.

Conceptual framework

Theoretical background

Our conceptual framework builds upon: (a) the work Pawson and Tilley (1997) presented in their book, *Realistic*

Evaluation; (b) our earlier work extending Pawson and Tilley's work to encompass communicable disease control programmes and heath systems through the Systemic Rapid Assessment (SYSRA) of health interventions (Atun *et al*. 2004; Coker *et al*. 2004); and (c) our further development of an analytical framework to conduct case studies on the integration of HIV/AIDS and TB control programmes and general health systems (Conseil *et al*. 2009). Pawson and Tilley (1997) attempted to go beyond the traditional research question often asked of programmes, that of asking simply whether a programme works or not, and instead attempted to develop a conceptual framework that provides an understanding of *why a programme works, for whom and in what circumstances*. They suggested several elements to evaluate a programme whilst acknowledging its complexity and the environment within which it sits, including: (i) context; (ii) epidemiological problem; (iii) intervention; (iv) mechanism; (v) outputs; and (vi) outcomes.

First, *context* denotes the political, legislative, social, economic and technological environments within which communicable disease control programmes sit. This environment may be global, regional, national or local. These contextual elements may also be *drivers*, that is, forces that operate to provide the initiative, resources and energy for the control of communicable diseases. Together, these components are part of the enabling or constraining environments, the foundation upon which a programme's success or failure ultimately depends.

Secondly, the *epidemiological problem* refers to infection levels and various disease characteristics. For example, this might relate to upstream risk factors such as the emergence of drug-resistant strains of TB or HIV, or clusters of diseases in congregate settings such as prisons and other institutions.

The third component is the *intervention* intended to serve public health. For example, in TB control this could be the DOTS strategy and its respective components. For HIV, this might be the prevention of mother-to-child transmission through the four-pronged approach, including the use of antiretroviral therapy (ART). Many interventions are recommended through clinical and policy guidelines and are evidence-based, thus lending themselves to scrutiny against gold standards.

The fourth element is the *mechanism* by which interventions are delivered. It is the mechanisms within a programme, required to function effectively, that are of critical interest in this comparative analysis for they make interventions operational. Interventions are often the focus of much evidence, through randomized controlled trials (RCTs) for example, yet the mechanisms by which these interventions are provided usually rest on a weaker evidence base. For example, a regular supply of quality-assured anti-TB drugs (the intervention) is a prerequisite for an effective control programme, yet questions remain regarding *how* this can best be achieved (the mechanism).

The fifth element of the conceptual framework relates to *outputs*. Outputs are public health concepts that can be measured or determined and include equity, acceptability, efficiency and effectiveness of the control programmes as a result of interventions. In a successful and sustainable programme, these outputs ideally result in *outcomes*, such as reduced incidence of disease or decreased mortality. A schematic representation of the overarching conceptual framework is illustrated here using TB as an example (Figure 1).

However, whilst the conceptual framework outlined above and illustrated in Figure 1 addresses many of the more obvious factors that inform the delivery of services in programmes, it does not explicitly address two issues of interest that are important in a comparative analysis of communicable disease control programmes and health systems, namely *health system functions* and *integration*.

Health system functions and interventions

Health system functions are essential to meeting health goals in an effective, efficient and equitable manner. To evaluate health system functions, we have further expanded Pawson and Tilley's framework by linking the health system functions described by Atun *et al*. (2004) to the *mechanisms* described above. Atun *et al*. (2004) previously defined six health system functions: (i) stewardship and governance; (ii) financing; (iii) planning; (iv) service delivery; (v) monitoring and evaluation; and (vi) demand generation. These functions consist of mechanisms that enable interventions to impact upon the health of populations (Figure 2).

As mentioned earlier, these six health system functions affect both disease-control programmatic success as well as broader health systems performance. Whilst Figure 1 conceptualizes health systems at the macro level through 'context', it also addresses the micro level through defined interventions that reach patients and populations. Figure 2, through the incorporation of health system functions, introduces the potential for meso level analysis, thus providing a holistic 'programme to general health system' conceptual framework. Figure 3 shows the six health systems functions related both to programmes and to the general health system, illustrated here by HIV and TB control programmes. These functions were the focus of analyses of integration between health systems and disease control programmes in the case studies' development (Desai *et al*. 2010; Mounier-Jack *et al*. 2010; Rudge *et al*. 2010; Hanvoravongchai *et al*. 2010)[2]. The analyses were conducted using an interview guide developed in July 2009, which served as the main tool to collect primary data in order to evaluate the extent and nature of integration of Global Fund programmes into national HIV and TB programmes, integration of the national HIV and TB programmes into the general health systems, and system-wide effects of Global Fund support on the health system. This guide built on the guide developed for a Vietnam case study (which focused mainly on integration of diseases programmes into the health system, without specific assessment of Global Fund support) also published in this supplement (Conseil *et al*. 2010).

Integration

In recent years, along with a revitalized enthusiasm for strengthening health systems, a debate has ensued about the relative benefits or detrimental effects of integrating disease control programmes that emphasize specific interventions, such as those for HIV, TB, malaria and vaccine-preventable infections and diseases, into mainstream health systems. The purpose of integrating programmes into broader health systems is to

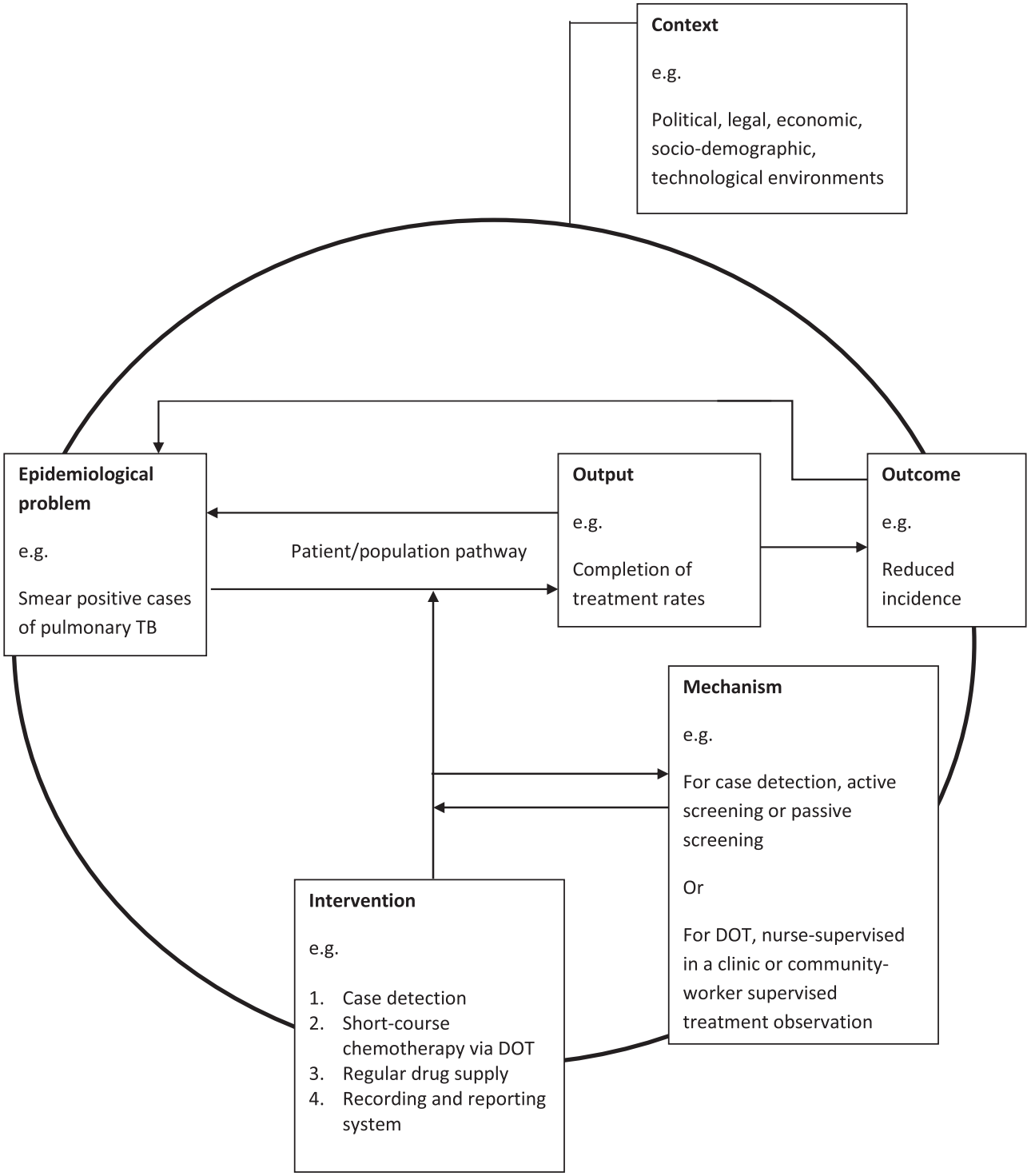

Figure 1 Schematic representation of the conceptual framework with tuberculosis as an illustrative example.

benefit public health through more effective, efficient, equitable and acceptable systems. Because the evidence base on the benefits of integration of programmes and health systems is weak, and because in recent years considerable investment through global health initiatives has occurred, there is a need to determine in a systematic fashion the extent and impact of integration of programmes and health systems.

For the purpose of this analysis, we suggest that the term 'integration' represents a spectrum of organizational arrangements related to the funding, administration, organization, service delivery and clinical scenarios designed to create connectivity, alignment and collaboration (Kodner and Spreeuwenberg 2002). The spectrum of integration ranges from no integration, to partial integration, to full integration,

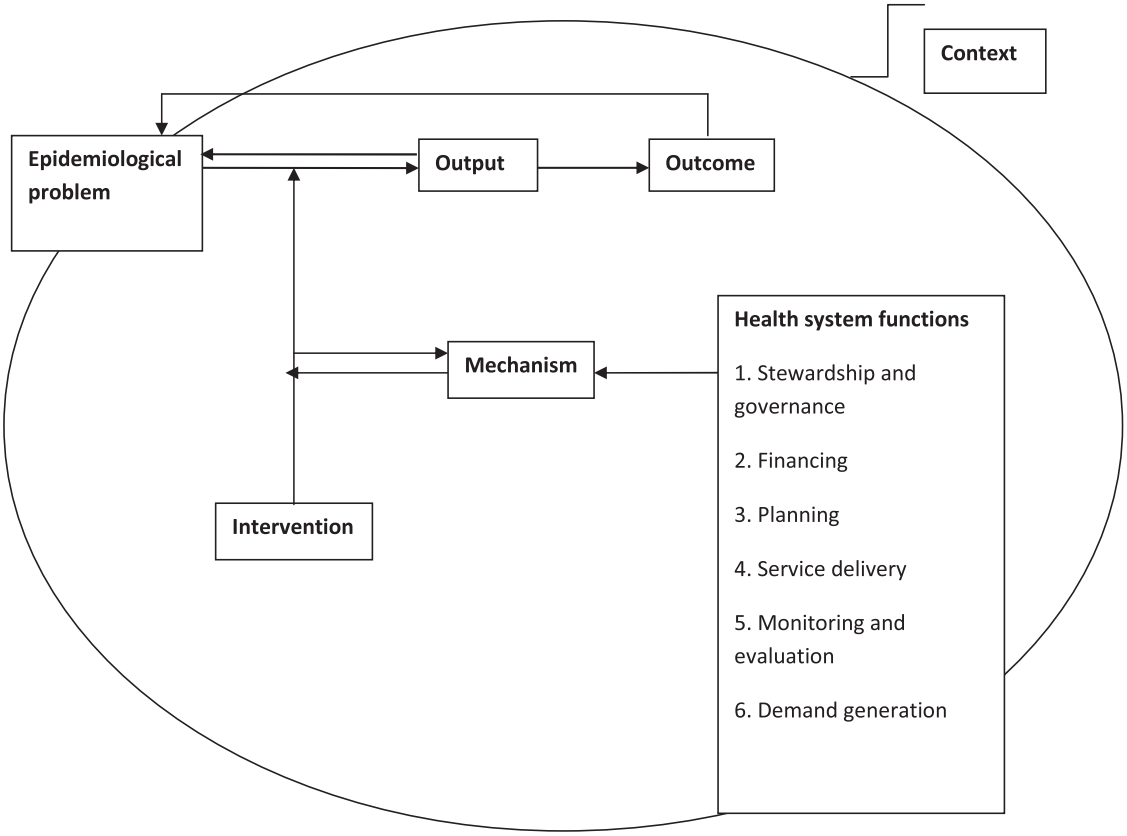

Figure 2 Schematic representation of health system functions and their linkage through mechanisms to interventions.

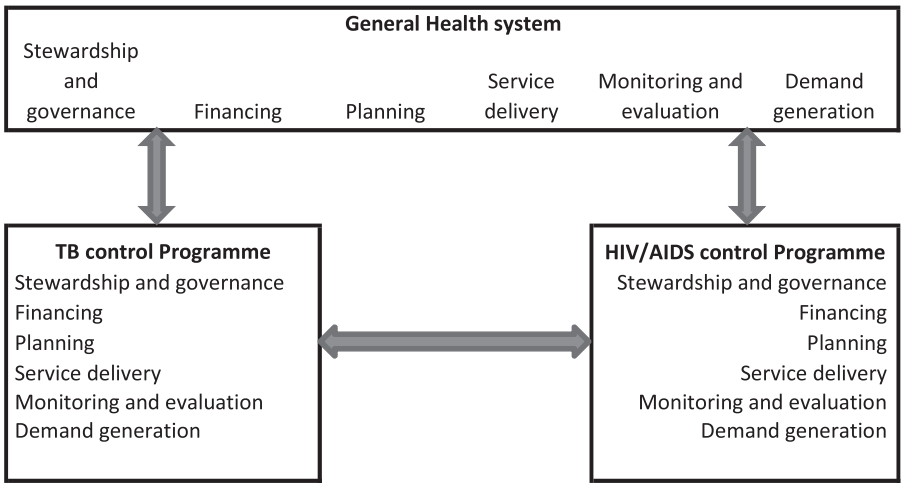

Figure 3 Schematic representation of health system functions at the general health system level and programmatic level.

and can be conceptualized as occurring to various degrees, across each of the different health system functions. The literature on integration is reviewed by Shigayeva *et al*. in this supplement (Shigayeva *et al*. 2010). Assessments of integration within several countries in South East Asia are also published in this supplement (Conseil *et al*. 2010; Desai *et al*. 2010; Hanvoravongchai *et al*. 2010; Mounier-Jack *et al*. 2010; Rudge *et al*. 2010; Trägård and Shrestha 2010).

Proposed analytical methods for comparative analysis

The seven domains that offer areas for comparative analyses of case studies as described above include:

(1) Context
(2) Epidemiological problem
(3) Interventions

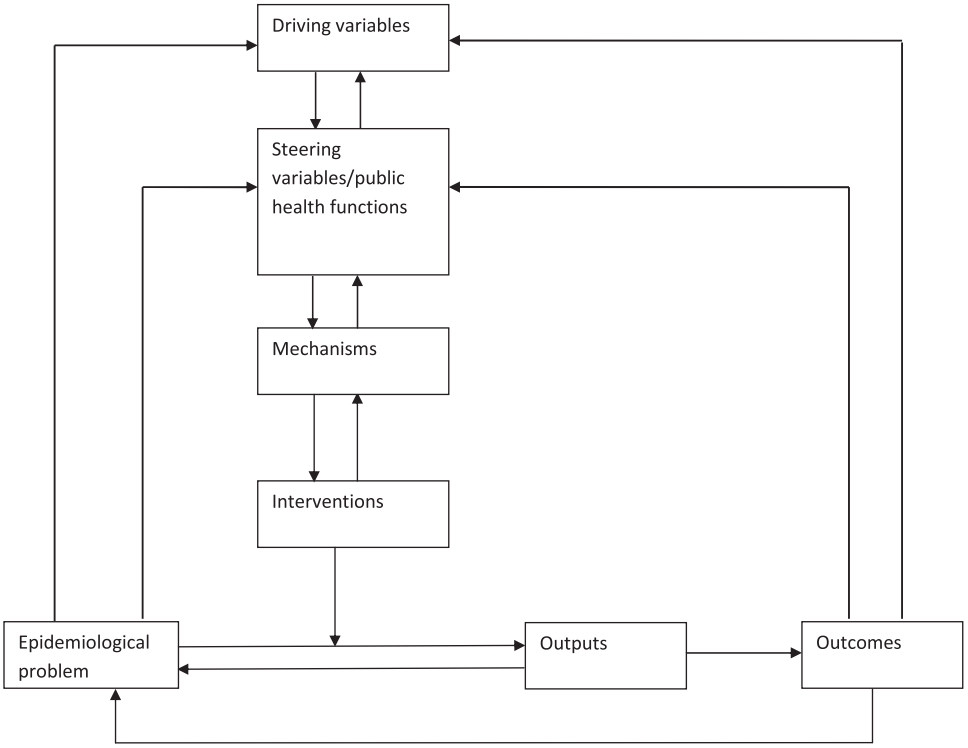

Figure 4 Schematic representation of the conceptual relationship between 'domains'.

(4) Mechanisms
(5) Public health functions and levels of integration
(6) Outputs
(7) Outcomes.

The proposed framework thus consists of seven fairly distinct domains, albeit interdependent and somewhat artificially divided. These domains can be compared across each case study. In particular, attention should be paid to public health functions and their levels of integration, this being the focus of the country case studies. In order to further explore the relationships between context and public health functions (and thereby their influences on mechanisms and interventions), we may define two broad categories: (i) *driving* variables; and (ii) *steering* variables.

By *driving* variables we mean in-country or global-level variables that provide the initiative, resources and energy for health systems development and integration where deemed likely to offer benefits. As a driving force, for example, Global Fund support provides the financing that is essential for programme development. Political leadership in identifying and prioritizing a specific disease to be addressed by government policy is another example. *Steering* variables, on the other hand, are likely to be predominantly domestic in origin and give expression to whether, where and how control efforts are energetically pursued, and whether integration of health system functions is a notion that is embraced and encouraged in pursuit of the effective deployment of mechanisms and interventions. Steering variables are likely to sit with programme and general health system functions. An example might be joint HIV and TB control planning meetings at national and local levels. Figure 4 illustrates the schematic relationship between driving and steering variables with other variables.

Integration scores

In this preliminary analysis we determine the degree of integration among health system functions between control programme and health system. Drawing upon the approach used in the country case studies from South East Asia, we construct 'indicators' that enable us to generate an index of relative scoring of different countries, drawing upon a combination of quantitative and qualitative data. The scale is ordinal, from 0 (no integration) to 2 (full integration) for each control programme and system function. The values do not imply support or even benefit gained, but merely the *level of integration* either between a programme and the general health system or between various programmes. These values can be compared across countries, whilst acknowledging and describing country differences across other variables, such as interventions, mechanisms, outputs and outcomes.

Importantly, the scores are a way of capturing differences in levels of integration and carry no connotations or implications regarding quality of care, efficiency, equity or even whether integration is a beneficial component to achieving public health goals. This noted, however, we can rank countries across variables and present plausible models of how different levels of integration are associated with outputs and outcomes given different/similar contextual settings, epidemiological patterns of disease, interventions and mechanisms.

In order to offer insights into national *patterns* we propose an analytic extension. By discerning patterns through correlations

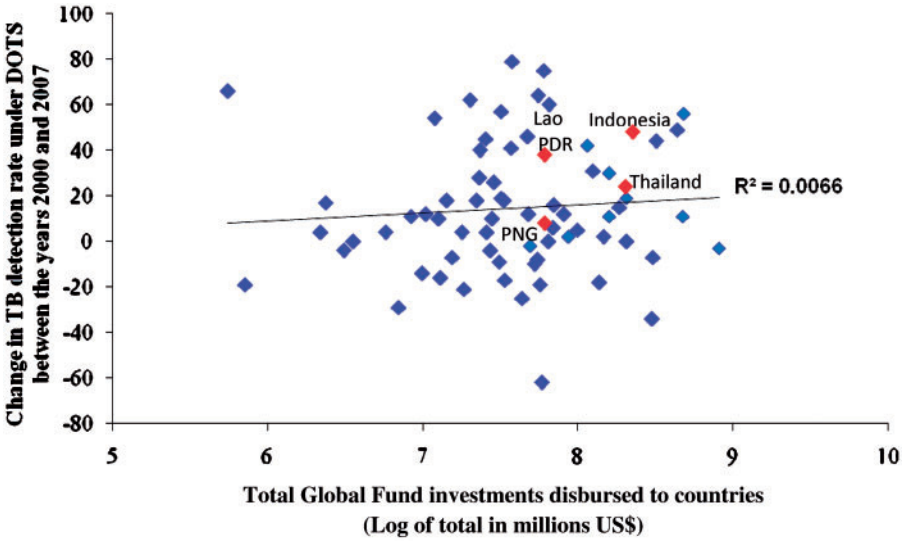

Figure 5 Scatterplot showing total sum of disbursed Global Fund investments to date, measured in US$ (shows as Log of millions of US$), and change in TB detection rate under DOTS, between the years 2000 and 2007.

between the impact on diseases, investments in HIV and TB programmes, associations with a wider range of morbidity indicators in public health areas not directly associated with substantial programmatic investments, trends that suggest associations with integration of health systems can be explored. It may be possible to quantitatively infer benefits, detrimental effects or a lack of correlation, and draw lessons from models of integration, develop hypotheses and test theories. Moreover, the strength of linkages among programmes and between programmes and the general health system can thus be analysed collectively, as has been done through country case studies.

Preliminary results

Comparative analysis of integration of disease control programmes into the general health system in four countries of South East Asia

Analyses through case studies offer insights, as Pawson and Tilley suggest, into what, why and how programmes and health systems work. Comparative analyses have the potential to offer additional insights. Ecological analyses draw upon aggregated data from groups of cases to make inferences about relationships, and can be considered a form of multi-level modelling (Steel *et al*. 2006). We present preliminary ecological analyses of disease outcomes associated with Global Fund investments and issues which are associated with wider health system strengthening in order to explore and illustrate relationships that may exist between investments in programmes subject to substantial financial support and the broader health impact on conditions not associated with programme investment but, at least in part, with wider health system functioning.

We briefly illustrate such an ecological approach, correlating Global Fund investments with an output of TB control programmes (as an illustration of a programme specific outcome, TB detection rates) and with under-5 mortality rates as an outcome dependent upon wider health system functioning (Figures 5 and 6). Figure 5 suggests there is little correlation to date between the total sum of disbursed Global Fund investments and TB case detection rates. This may be the result of several factors, including increased investments leading to increased clinical awareness, strengthened surveillance and higher rates of disease detection. Figure 6 shows percentage changes in the under-5 mortality rate (wider health system outcome) between the years 2000 and 2007, and the total sum of approved Global Fund investments to-date. The data indicate a weak association (correlation co-efficient 5.8) between Global Fund investments and wider health outcomes, as illustrated by reductions in under-5 mortality rates. This lack of correlation may be a function of numerous influences including funding for specifically targeting neonatal and child health issues (for example, GAVI funding), immunization coverage and overall increased health awareness, among others.

These simple ecological analyses suggest that further understanding of the relationships between investments and health outcomes is necessary. We ask the question: is integration of programme and health systems as a result of Global Fund investments associated with improved health outcomes?

Integration score

The integration scores used in the analyses were derived from data collected and collated as part of the country case studies, for which methodological details are provided in Conseil *et al*. (2010). In this study, country reports were re-evaluated by a researcher not previously involved in the country case studies, who scored each of the 25 elements of integration among six health system functions according to the following scale: 'not/predominantly not integrated' = 0; 'partially integrated' = 1; and 'fully/predominantly integrated' = 2. Scores for each of the six functions (stewardship and governance, finance, planning, service delivery, monitoring and evaluation, and demand

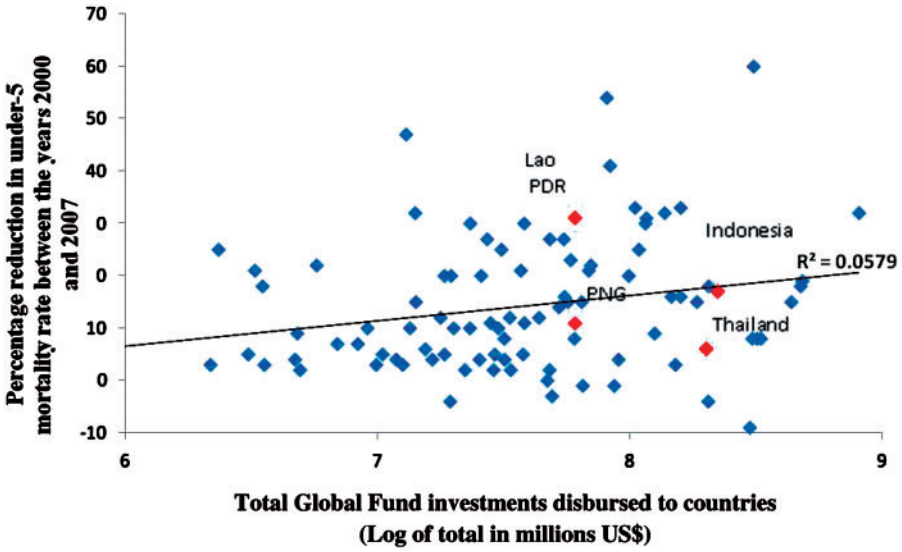

Figure 6 Scatterplot showing total sum of disbursed Global Fund investments to date, measured in US$ (shows as Log of millions of US$), and percentage reduction in national under-5 mortality rate, between the years 2000 and 2007.

generation) were then checked and confirmed by country case study authors, and where amendments were necessary, this was done by going back to the original data and re-evaluating it in collaboration with country case study authors.

Overall aggregate scores were based on equal weights for the integration of TB control programmes and HIV/AIDS control programmes into the health system, as adjusting for disease prevalence made little impact on the aggregate scores. Each country had a final aggregate integration value ranging from 0 to 24, where higher values indicate greater integration. The level and scope of integration of Global Fund-supported HIV and TB control programmes into general health systems varied widely across the country case studies we draw upon in this analysis, from almost fully integrated (score 23), in Thailand, to primarily vertical (score 6), in Vietnam (Conseil *et al*. 2010; Desai *et al*. 2010; Hanvoravongchai *et al*. 2010; Mounier-Jack *et al*. 2010; Rudge *et al*. 2010). These results are illustrated for the health system overall and, as an illustration, for one public health function—service delivery—which has been further broken down into its specific elements (relating to infrastructure, humans resources, and procurement and supply systems) for each of the countries (Tables 1 and 2).

Indeed, the level of integration across public health functions in the four countries indicated that certain health functions tended to show similar patterns of integration. For instance, monitoring and evaluation (M&E) for HIV and TB was weakly integrated within the overall M&E system (with the exception of Thailand), due in part to specific requirements of donors. Similarly, the financing function of HIV and TB programmes was typically weakly integrated with general health system financing. Conversely, service delivery and demand generation for both HIV/AIDS control and TB control were partially or fully (in the case of Thailand) integrated into the health system in each of the case studies. Where demand generation for disease-specific programmes was not fully integrated, this tended to be either because providers were non-governmental organizations (NGOs), or because the general health care system failed to reach the target population, as is the case for most-at-risk groups for HIV. By contrast, comparison of disease control programme service delivery showed that human resources and infrastructure tended to be partly, or sometimes fully, integrated within general health services, particularly at decentralized levels and when disease prevalence was relatively high, as seen in the case of TB in Indonesia, Lao PDR and PNG. At the front-line level, multi-functional personnel often delivered comprehensive care to patients, including those targeted by the disease control programmes.

Integration and its association with health outcomes

To test the assumption that changes in health outcomes are associated with differences in the degree of integration of cross-programme and programme-system health system functions, we compare changes in under-5 mortality rates with funds disbursed by the Global Fund, without incorporating integration values (Figure 7a) and then by adjusting per unit of integration according to the scores calculated for each country, as described above (Figure 7b). Figure 7a shows a positive but fairly weak association between Global Fund investment and change in under-5 mortality rates, with an R^2 value of 0.383 indicating that a large proportion of variation in the data among these five countries remains unexplained. When this relationship was further explored by incorporating a variable corresponding to the relative level of integration between disease control programmes and the health system, we found that the correlation co-efficient decreased substantially ($R^2 = 0.074$) (Figure 7b). This decrease corresponds to variations in the relative position of the countries along the y axes, with Vietnam now seeming to be an outlier. Thus, at least in this preliminary analysis, increased levels of aggregate integration of health systems and programmes is not associated with

Table 1 Scoring for disease control programme–health system integration, using data from country case studies (Indonesia, Lao PDR, Papua New Guinea, Thailand) and Vietnam. Aggregate scores correspond to a sum of TB control programme–health system integration and HIV control programme–health system integration, where 0 = no integration, 1 = partial integration and 2 = full integration for each of the programmes

	Health system function						
Country	Stewardship & governance	Finance	Planning	Service delivery	Monitoring & evaluation	Demand generation	Aggregate system score*
Indonesia	2	1	2	2	1	2	10
Lao PDR	2	0	2	2	2	2	10
Papua New Guinea	2	2	2	2	0	2	10
Thailand	4	4	4	4	4	3	23
Vietnam	1	0	0	2	1	2	6

*Aggregate score based on equal weights for the integration of TB control programmes and HIV/AIDS control programmes into the health system. When adjusted for disease prevalence, this made little impact on the aggregate score. As total disbursed funds do not always correspond to disease burdens, we did not weight according to funding.

Table 2 Aggregate scoring for one health system function (service delivery) using data from country case studies (Indonesia, Lao PDR, Papua New Guinea, Thailand) and Vietnam. Component scores correspond to level of programme–system integration, where 0 = no integration, 1 = partial integration and 2 = full integration for each of the components. Aggregate function scores correspond to a sum of component scores, where 0–2 = no integration, 3–5 = partial integration and 6–8 = full integration

	Service delivery variable				
Country	Human resources	Shared infrastructure	Laboratory services	Drug supply management	Aggregate function score*
Indonesia	1	1	1	1	4
Lao PDR	1	1	1	0	3
Papua New Guinea	2	1	1	0	4
Thailand	2	2	2	2	8
Vietnam	1	2	0	1	4

*Component scores were given equal weights and summed to produce the aggregate score.

improving outcomes associated with increasing Global Fund investments. Why Vietnam is such an outlier in this analysis is unclear and could be the focus of further analysis.

Although this example of an ecological analysis exploring the apparent impact of integration of health systems is necessarily limited by a small number of case studies, this approach could be taken further in order to yield valuable insights. For example, analyses of all 140 countries, where programmatic output and health outcome data exist along with donor investment might be expanded to explore correlations between absolute financing, proportion of health budget spending on programmes, proportion of donor funding on programmes and trends in financing, among other investment variables, and their associations with integration by health system function. As data on integration become available along with a harmonized metric, a series of additional quantitative ecological analyses could be undertaken to determine, at a granular level, associations between both aggregate scores of integration and also disaggregated scores of key functions, investments and health outcomes. Correlation of alternative health outputs and outcomes could be expanded and include, for example, programme-specific health outputs, non-programme-specific outcomes such as avoidable mortality, maternal mortality, neonatal mortality and/or with trends in the above, over time.

Such analyses will likely result in plausible models for integration, and the programmatic and non-programmatic benefits that appear to be associated, as well as testable hypotheses related to health systems and integration.

Conclusion

Interest in health systems analysis and in the comparative analysis of health systems has grown over the past decade and has gained increased urgency with investments from new institutions and the shifting global health governance architecture. Questions regarding what works, where, why and how are critically important for all interested parties and answers are necessary if public health systems are to function most effectively to achieve desired public health goals. Most studies to-date on health systems and communicable disease control have been limited, especially when addressing the issue of integration of functions between vertical disease control programmes and horizontal health systems.

We have attempted to offer here an approach that builds upon a body of work that has informed country case study conduct, and build upon a wider debate surrounding notions of integration. We acknowledge that there are limitations to comparative analyses of case studies. This is, however, an attempt to support the further development of an analytical approach in a pragmatic manner, offering what we hope are important insights to inform improved health investments and ultimately to improve public health outcomes.

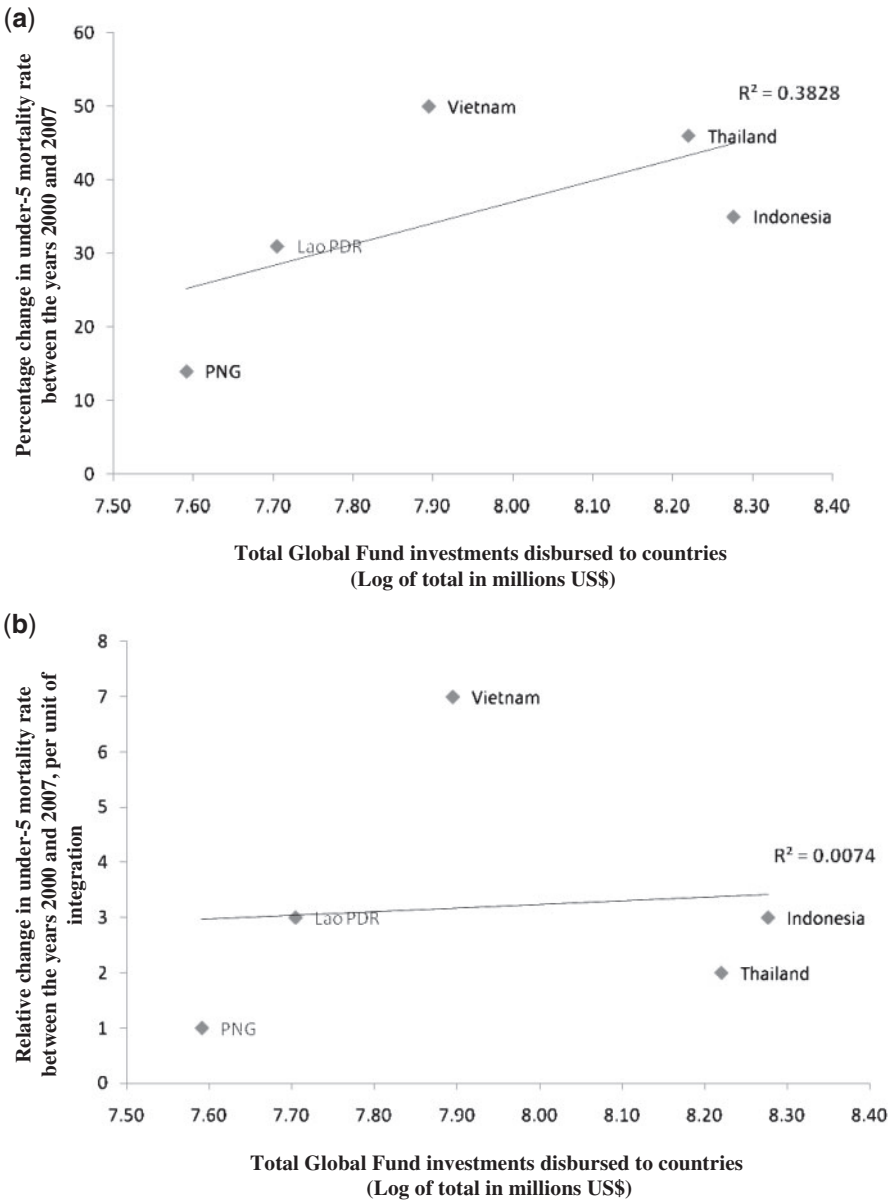

Figure 7 Comparison of percentage reduction in national under-5 morality rate between the years 2000 and 2007 and total sum of disbursed GFATM investments to date, measured in US$, shown (a) without incorporating integration score and (b) when adjusted for integration score.

Authors' contributions

All authors were involved in critical revision of the manuscript and read and approved the final manuscript.

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Conflict of interest

Co-authors R Atun and J V Lazarus are staff at the Global Fund, as Director of the Strategy, Performance and Evaluation Cluster, and Team Leader for Technical Publications and Learning, respectively.

Endnotes

[1] For the purpose of this work, the definition of a health system is 'a set of relationships in which the structural components (means) and their interactions are associated and connected to the goals the system desires to achieve (ends)' (Hsiao and Heller 2000).

[2] Country case studies submitted in parallel with this article to this supplement of *Health Policy and Planning*.

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